I'm not robot

reCAPTCHA

Continue

Alexander friedman and george lemaitre

A2.5 La cosmología moderna contexto histórico Lee el siguiente resumen con las aportaciones de los científicos y realiza las actividades que te proponemos al final del mismo. Albert Einstein 1915. Teoría de la relatividad general Proporciona una descripción matemática del Universo. Da una respuesta errónea a la existencia de un cosmos eterno y estático. Introduce la constante cosmológica en sus ecuaciones al fin de contrarrestar la gravitación y “frenar” la expansión acelerada del Universo. Alexander Friedman En 1922 examina las ecuaciones de la relatividad de Einstein y llega a la conclusión de que al eliminar la constante cosmológica, admiten varias soluciones, entre ellas el Universo en expansión. George Lemaitre En 1927, llega a las mismas conclusiones que Friedman y propone su modelo del átomo primordial, que contiene toda la materia y la energía a partir de la cuál se formó el Universo. Fue el precursor de la teoría del Big Bang Edwin Hubble En 1929 demuestra experimentalmente la expansión del Universo. Comparó las distancias de las galaxias en función a su velocidad con las que se alejaban unas de otras y dedujo que cuanto más lejos estaban, más rápido se movían. Relación conocida como ley de Hubble. George Gamow En 1948 elabora junto con Ralph Alpher y Hans Bethe el modelo cosmológico del Big Bang y demuestran como se llevó a cabo en las estrellas la creación de los primeros elementos químicos. Fred Hoyle En 1948 propone junto con Thomas Gold y Herman Bandi el modelo cosmológico dinámico e infinito del estado estacionario. Bautiza despectivamente como Big Bang a la teoría de Gamow, que consideraba errónea. El cree en un Universo en expansión, pero infinito y sin un principio definido, en el que se genera materia de forma continua, mediante mecanismos indefinidos. La relatividad: a) ¿Qué estudia la cosmología? b) ¿Qué función desempeñó la constante cosmológica en las ecuaciones de la relatividad general de Einstein? c) ¿A qué conclusiones llegaron Alexander Friedmann, George Lemaître Y Edwin Hubble? d) ¿En qué se parecen y en qué se diferencian los modelos cosmológicos del Big Bang y del estado estacionario? e) Compara la posición de las bandas espectrales de absorción de elementos químicos presentes en las galaxias A y B con los que se obtienen en el laboratorio para los mismos elementos químicos C. Explica el fenómeno producido y deduce cuál de las dos galaxias A y B está más lejos de la Tierra. Anterior Siguiente Aleksandr Fridman Aleksandr FridmanFödd16 juni 1888Sankt Petersburg, RysslandDöd16 september 1925Leningrad, RysslandNationalitetRysslandForskningsområdeKosmologiNämnvärda studenterGeorge Gamow Aleksandr Aleksandrovitj Fridman (Александр Александрович Фридман), född 16 juni 1888, död 16 september 1925, i engelskspråkig litteratur oftast känd som Alexander Friedmann, var en rysk matematiker och kosmolog. Han upptäckte år 1922 lösningar till Albert Einsteins allmänna relativitetsteori som tillät ett expanderande universum, vilket bekräftades av Edwin Hubbles mätningar år 1929 och numera ingår i Big Bang-teorin. Dessa lösningar upptäcktes senare oberoende av Georges Lemaître. Lösningarna sammanfattas i det som numera inom kosmologin kallas Friedmanns ekvationer. Vidare kallas den rumtid som tidigare kallades Robertson-Walker-metriken numera ofta Friedmann-Lemaître-Robertson-Walker-metriken. Aleksandr Fridman levde största delen av sitt liv i Sankt Petersburg. Han tjänstgjorde i första världskriget för Ryssland. Han lärde också upp en annan känd fysiker; George Gamow. Fridman dog av tyfus endast 37 år gammal. Externa länkar Wikimedia Commons har media som rör Aleksandr Fridman.Bilder & media Hämtad från " A few years ago I was asked to provide a short description of the history of cosmology, from the dawn of civilisation up to the establishment of the Big Bang model, in less than 1200 words. This is what I came up with. Who and what have I left out that you would have included? –0– Is the Universe infinite? What is it made of? Has it been around forever? Will it all come to an end? Since prehistoric times, humans have sought to build some kind of conceptual framework for answering questions such as these. The first such theories were myths. But however naïve or meaningless they may seem to us now, these speculations demonstrate the importance that we as a species have always attached to thinking about life, the Universe and everything. Cosmology began to emerge as a recognisable scientific discipline with the Greeks, notably Thales (625-547 BC) and Anaximander (610-540 BC). The word itself is derived from the Greek “cosmos”, meaning the world as an ordered system or whole. In Greek, the opposite of “cosmos” is “chaos”. The Pythagoreans of the 6th century BC regarded numbers and geometry as the basis of all natural things. The advent of mathematical reasoning, and the idea that one can learn about the physical world using logic and reason marked the beginning of the scientific era. Plato (427-348 BC) expounded a complete account of the creation of the Universe, in which a divine Demiurge creates, in the physical world, imperfect representations of the structures of pure being that exist only in the world of ideas. The physical world is subject to change, whereas the world of ideas is eternal and immutable. Aristotle (384-322 BC), a pupil of Plato, built on these ideas to present a picture of the world in which the distant stars and planets execute perfect circular motions, circles being a manifestation of “divine” geometry. Aristotle’s Universe is a sphere centred on the Earth. The part of this sphere that extends as far as the Moon is the domain of change, the imperfect reality of Plato, but beyond this the heavenly bodies execute their idealised circular motions. This view of the Universe was to dominate western European thought throughout the Middle Ages, but its perfect circular motions did not match the growing quantities of astronomical data being gathered by the Greeks from the astronomical archives made by the Babylonians and Egyptians. Although Aristotle had emphasised the possibility of learning about the Universe by observation as well as pure thought, it was not until Ptolemy’s Almagest, compiled in the 2nd Century AD, that a complete mathematical model for the Universe was assembled that agreed with all the data available. Much of the knowledge acquired by the Greeks was lost to Christian culture during the dark ages, but it survived in the Islamic world. As a result, cosmological thinking during the Middle Ages of Europe was rather backward. Thomas Aquinas (1225-74) seized on Aristotle’s ideas, which were available in Latin translation at the time while the Almagest was not, to forge a synthesis of pagan cosmology with Christian theology which was to dominated Western thought until the 16th and 17th centuries. The dismantling of the Aristotelian world view is usually credited to Nicolaus Copernicus (1473-1543). Ptolemy’s Almagest was a complete theory, but it involved applying a different mathematical formula for the motion of each planet and therefore did not really represent an overall unifying system. In a sense, it described the phenomena of heavenly motion but did not explain them. Copernicus wanted to derive a single universal theory that treated everything on the same footing. He achieved this only partially, but did succeed in displacing the Earth from the centre of the scheme of things. It was not until Johannes Kepler (1571-1630) that a completely successful demolition of the Aristotelian system was achieved. Driven by the need to explain the highly accurate observations of planetary motion made by Tycho Brahe (1546-1601), Kepler replaced Aristotle’s divine circular orbits with more mundane ellipses. The next great development on the road to modern cosmological thinking was the arrival on the scene of Isaac Newton (1642-1727). Newton was able to show, in his monumental Principia (1687), that the elliptical motions devised by Kepler were the natural outcome of a universal law of gravitation. Newton therefore re-established a kind of Platonic level on reality, the idealised world of universal laws of motion. The Universe, in Newton’s picture, behaves as a giant machine, enacting the regular motions demanded by the divine Creator and both time and space are absolute manifestations of an internal and omnipresent God. Newton’s ideas dominated scientific thinking until the beginning of the 20th century, but by the 19th century the cosmic machine had developed imperfections. The mechanistic world-view had emerged alongside the first stirrings of technology. During the subsequent Industrial Revolution scientists had become preoccupied with the theory of engines and heat. These laws of thermodynamics had shown that no engine could work perfectly forever without running down. In this time there arose a widespread belief in the “Heat Death of the Universe”, the idea that the cosmos as a whole would eventually fizzle out just as a bouncing ball gradually dissipates its energy and comes to rest. Another spanner was thrown into the works of Newton’s cosmic engine by Heinrich Olbers (1758-1840), who formulated in 1826 a paradox that still bears his name, although it was discussed by many before him, including Kepler. Olbers’ Paradox emerges from considering why the night sky is dark. In an infinite and unchanging Universe, every line of sight from an observer should hit a star, in much the same way as a line of sight through an infinite forest will eventually hit a tree. The consequence of this is that the night sky should be as bright as a typical star. The observed darkness at night is sufficient to prove the Universe cannot both infinite and eternal. Whether the Universe is infinite or not, the part of it accessible to rational explanation has steadily increased. For Aristotle, the Moon’s orbit (a mere 400,000 km) marked a fundamental barrier, to Copernicus and Kepler the limit was the edge of the Solar System (billions of kilometres away). In the 18th and 19th centuries, it was being suggested that the Milky Way (a structure now known to be at least a billion times larger than the Solar System) to be was the entire Universe. Now it is known, thanks largely to Edwin Hubble (1889-1953), that the Milky Way is only one among hundreds of billions of similar galaxies. The modern era of cosmology began in the early years of the 20th century, with a complete re-write of the laws of Nature. Albert Einstein (1879-1955) introduced the principle of relativity in 1905 and thus demolished Newton’s conception of space and time. Later, his general theory of relativity, also supplanted Newton’s law of universal gravitation. The first great works on relativistic cosmology by Alexander Friedmann (1888-1925), George Lemaître (1894-1966) and Wilhem de Sitter (1872-1934) formulated a new and complex language for the mathematical description of the Universe. But while these conceptual developments paved the way, the final steps towards the modern era were taken by observers, not theorists. In 1929, Edwin Hubble, who had only recently shown that the Universe contained many galaxies like the Milky way, published the observations that led to the realisation that our Universe is expanding. That left the field open for two rival theories, one (“The Steady State”, with no beginning and no end) in which matter is continuously created to fill in the gaps caused by the cosmic expansion and the other in which the whole shebang was created, in one go, in a primordial fireball we now call the Big Bang. Eventually, in 1965, Arno Penzias and Robert Wilson discovered the cosmic microwave background radiation, proof (or as near to proof as you’re likely to see) that our Universe began in a Big Bang… Follow @telescoper Ninety years ago, in 1922, Alexander Friedman (1888-1925) demonstrated for the first time that the General Relativity equations admit non-static solutions and thus the Universe may expand, contract, collapse, and even be born. The fundamental equations he derived still provide the basis for the current cosmological theories of the Big Bang and the Accelerating Universe. Later, in 1924, he was the first to realize that General Relativity allows the Universe to be infinite. Friedman's ideas initially met strong resistance from Einstein, yet from 1931 he became their staunchest supporter. This essay connects Friedman's cosmological ideas with the 1998-2004 results of the astronomical observations that led to the 2011 Nobel Prize in Physics. It also describes Friedman's little known topological ideas of how to check General Relativity in practice and compares his contributions to those of Georges Lemaître. Recently discovered corpus of Friedman's writings in the Ehrenfest Archives at Leiden University sheds some new light on the circumstances surrounding his 1922 work and his relations with Paul Ehrenfest. Einstein Special Relativity General Relativity Friedmann Credit: Emilio Segre Visual Archives Einstein Albert Einstein is probably the most recognisable and famous scientist in the world today even though he died six decades ago. 2005 was celebrated as the World Year of Physics to commemorate the centenary of the papers he wrote in 1905 on three key topics in Physics: The photoelectric effect and the photon. Einstein applied the concept of the discrete package of energy, the quantum, discovered by the German physicist Max Planck to explain the photoelectric effect. Attempts to explain this effect, in which ultraviolet or blue light knocked electrons off a metal plate when even high levels of red light could not, using classical physics had all failed. By considering light to behave as discrete particles called photons rather than as a wave Einstein was able to successfully account for the observations. Light therefore was quantised, with the energy of a photon being proportional to its frequency. It was for his work on this topic and not relativity that Einstein was awarded the Nobel Prize in Physics in 1921. Brownian motion and the size of atoms. In 1827 the Scottish botanist Robert Brown observed and described the random motion of tiny grains of pollen under a microscope. This motion was subsequently termed Brownian motion defied attempts by scientists to satisfactorily explain it until 1905. Einstein accounted for this motion by stating that minute atoms move randomly in a liquid and collide with the pollen grains. He proposed a means to measure both the size and average speed of the atoms. This work was instrumental in convincing scientific sceptics of the reality of atoms. The special theory of relativity. Einstein's work on special relativity changed the way we view time and mass. The term 'special' in his theory refers to the fact that Einstein limited his discussion to the special case of non-accelerated objects, that is objects moving in a straight line at constant speed. The key concept in special relativity is that the speed of light, c, is the same for any observer in an inertial (ie unaccelerated) frame of reference. Two observers, one moving much faster then the other, both measure the speed of light to be the same. from this premise we get some interesting phenomena. Rather than being fixed, the mass of an object is dependent on its speed. As an object approaches the speed of light, its mass increases. This relativistic mass increase has been measured to high precision in many situations. Einstein also realised that a direct realtionship existed between energy and mass, indeed that the two were interchangeable. This gave rise to his famous equation: E = mc2 (2.1) where E is energy, m is the mass of an object and c is the speed of light in a vacuum. The importance of this relationship is that a small amount of mass can be converted into a large amount of energy. The realisation of this ultimately led other scientists to the discovery of nuclear fission (the splitting of the atom) and the development of atomic weapons in the Second World War. It also provided an explanation for the source of energy in stars such as our Sun. Nuclear fusion, in which light nuclei such as hydrogen fuse together produce a new, heavier nucleus in which the mass is slightly less than the sum of the original nuclei. A small amount of mass is converted into high energy gamma ray photons. Special relativity also introduces the concepots of time dilation and length contraction. These can be used to explain the detection at the Earth's surface of muons from cosmic ray showers even though they should decay before they have time to reach it. General Relativity By 1916 Einstein had extended his earlier work on relativity to encompass more general situations including gravity and accelerated motion. This became known as the general theory of relativity and is a theory of gravity, the key long-range force in the Universe. He derived it from a key postulate, the principle of equivalence between inertial and gravitational forces. An object with mass not only possesses inertia but actually warps or curves space around it. It affects spacetime. The concept of four-dimensional spacetime had been applied to relativity by Minkowki in 1908. Motion and forces act along straight lines but where space is curved due to the presence of matter, the path followed by an object or light thus also appears curved. The predicted curvature of light around a massive object was dramatically verified by the British astrophysicist, Sir Arthur Eddington in 1919. Observations made by his teams in Brazil and West Africa measured the apparent shift in light from a star close to the Sun during a solar eclipse, fitting Einstein's predictions. This successful confirmation was largely responsible for the rapid acceptance of Einstein's work and his global fame. Einstein showed that Newton's theory of gravity was really a subset of more general conditions covered by general relativity. General relativity can account for the observed precession of the perihelion of Mercury about the Sun and the observed difference in hydrogen maser clocks in satellites orbiting Earth compared with those on the ground. Credit: John Rowe Animations An artist's impression of the double pulsar system. General Relativity has been tested to incredible precision. The recent discovery of a double pulsar system J0737-3039 using the Parkes radio telescope in which two pulsars orbit each other provides an outstanding natural laboratory for testing general relativity in extreme conditions. Numerous examples of gravitational lensing have now been observed by astronomers. Gravity Probe B, launched in 2004, uses gyroscopes in a polar-orbiting satellite space to test the concept of frame-dragging. This was a previously untested aspect of general relativity. General relativity is not just on interest to astrophysicists and gravitational wave physicists. The modern GPS satellite system can only function due to the application of general relativistic corrections to the orbits of each of the over twenty satellites in the system. The growing commercial, military and safety applications of such navigation systems show the relevance of general relativity in the modern world. Aleksandr Friedmann (1888 - 1925) Credit: Emilio Segre Visual Archives Friedmann Friedmann was a Russian mathematician and meteorologist who lived a short but eventful life. During the revolution of 1917 whilst besieged by White Russian forces in Petrograd (now St. Petersburg) he heard about Einstein's work on general relativity. He started to derive solutions, publishing his findings in 1922. His key insight was to realise that there was no unique solution to Einstein's equations, rather there was a whole family of solutions possible. This family of solutions thus allowed for different cosmological models of the Universe. In Friedmann's models the only force that is considered is gravitation. His model universes are homogeneous (the same everywhere on a large enough scale) and isotropic (look the same in every direction). Most importantly they incorporate the concept of expansion and in some cases, contraction. Einstein himself had viewed the Universe as static. Friedmann thus provided the theoretical framework for an expanding Universe within the spaceteime and mathematics of general relativity. Unfortunatley he contracted typhoid and and died in 1925 during the Russian civil war before his work became widely known. Credit: AIP Emilio Segre Visual Archives Georges Lemaître Friedmann's work was independently verified in 1927 when the Belgian astrophysicist and priest Georges Lemaître derived the same solutions, unaware of Friedmann's earlier work. Lemaître also realised that the newly discovered galaxies could be used to show the expansion of the Universe. The observational evidence for this was forthcoming through the work of Edwin Hubble. Lemaître went on to apply thermodynamics and quantum theory to consider the entropy or state of order of the Universe. He realised that if the disorder increased over time then the converse should also apply if one went back in time. This led him in 1927 to propose the concept that the Universe began as a primeval atom. His theory suggested that all of the mass-energy (1051 kg) of the universe was concentrated in a single super-atom about one astronomical unit across. The primeval atom would then fragment and the universe expand. Lemaître's concept was a precursor of the big bang model.